UNITED STATES DISTRICT COURT
DISTRICT OF MINNESOTA

ANDERSEN CORPORATION, Plaintiff, v. FIBER COMPOSITES, LLC., Defendant.	CIV NO. 00-CV-2548 (JNE/JGL)

EXHIBIT B

FIBER COMPOSITES' MOTION IN LIMINE TO EXCLUDE ANDERSEN FROM INTRODUCING ANY EVIDENCE RELATING TO THE PRIOR ART NOT SPECIFIED IN ANDERSEN'S RESPONSE OF JANUARY 8, 2002

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MINNESOTA

ANDERSEN CORPORATION, Plaintiff, v. FIBER COMPOSITES, LLC, Defendant.	Civil Action No. 00-CV-2548 RHK/AJB

Defendant's Prior Art Statement

Defendant Fiber Composite, LLC ("Fiber Composites") hereby submits its Prior Art Statement, pursuant to the Court's Pretrial Scheduling Order. The following Statement contains a list of the prior art upon which Fiber Composites, as currently advised, relies and an explanation of what the prior art shows and how that prior art invalidates the claims asserted by plaintiff Andersen Corporation ("Andersen"). Fiber Composites reserves the right to amend and supplement this Prior Art Statement based on the disclosure, discovery or production of additional information including, without limitation, test results and expert reports. Fiber Composites also reserves the right to supplement this Prior Art Statement in light of any amendments to the pleadings or future rulings from the Court including, without limitation, rulings on claim construction, infringement or validity.

Attachments A and B are incorporated by reference and included. Attachment A describes the prior art references generally with respect to the state of the art prior to the filing of the earliest application that resulted in issuance of any patent in suit, and

identifies and describes with respect to each individual reference pertinent examples of the disclosure of the reference.

Attachment B cross-references representative prior art references with the limitations of the claims asserted by Andersen in its claim chart. Attachment B is not meant to limit Fiber Composite's reliance upon the references identified and discussed in Attachment A and is not meant to refer to the proper construction of the limitations, which is the subject of other pleadings.

Dated: Nov. 1, 2001

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A

IDENTIFICATION OF PRIOR ART

A. GENERAL STATEMENT AS TO THE STATE OF THE ART

The following references illustrate the state of the art in wood fiber/PVC extruded products before the filing of the asserted Andersen patents. Reference 39 discloses the Andersen process from drying the wood flour, to extruding and pelletizing the wood/polymer material and finally extruding a product from the pellets. See Reference 39 at 40. Thus, it was well know in the art to mix polymers and wood in varying weight ratios as claimed in the Andersen patents. References 1 and 3 disclose wood/PVC mixtures and products containing wood/PVC ratios claimed in the asserted patents. The use of waste wood flour or sawdust mixed with waste PVC to produce extruded structures was also known. See, e.g., Reference 1. Further, it was within the ordinary skill of one in the art that wood flour and sawdust generally have an aspect ratio greater than 2. See, e.g., Reference 39. Thorough mixing of the wood and PVC under elevated heat and pressure is inherent in an extrusion process.

Further, it was well known to use the extrusions made from the wood/PVC combination to create structural components, such as window frames. See, e.g., reference 1 at page 5, line 5. Products made of wood/PVC combinations displayed improved properties, including an improved Young's Modulus of 850,000 psi and thermal expansion of 1.7×10^{-5} in/in ^{o}F. See, e.g., Reference 3.

Attachment B relates references 1 and 3, among others, to the asserted claim elements.

B. WHY THE REFERENCES ARE PRIOR ART

For references dated more than one year prior to August 31, 1992, the earliest filing date of the patents in suit, the references are statutory prior art under 35 U.S.C. Section 102. No separate discussion for such references is necessary as the prior art status is apparent. Where the reference is dated less than one year prior to August 31, 1992, the basis for asserting the references as prior art is stated.

C. IDENTIFICATION OF PRIOR ART UPON WHICH FIBER COMPOSITES RELIES

In addition to the elements of the claimed patents expressly disclosed, it would be obvious to one of ordinary skill in the art to modify the compositions described in the following references, e.g., by substitution of polymers, by substitution of wood fiber materials, and by details of processing, to obtain the claimed compositions. Further, the claimed characteristics of the compositions may be inherent in one or more of the prior art compositions, although not expressly discussed in the reference, which may be shown by expert analysis, testing, and testimony.

1. WO 90/08020 – Process of Producing a Wood-Plastic Agglomerate and Use Thereof (January 10, 1989)

The WO 90/08020 patent to Wuorela discloses, *inter alia*, a wood/plastic product that "contains 5-90% by weight plastic and 95-10% by weight wood waste, suitably 40-60% by weight plastic and 60-40% by weight wood waste." Col. 4, lines 17-20. The wood particles are described as 0.02-10mm in size, and preferably 2-3 mm. Col. 4, lines 7-8. The moisture content of the wood can be "5-45% by weight, suitably 10-40% by weight, and most preferably 15-25% by weight." Col. 4, lines 10-12. "The plastic employed is preferably a thermoplastic, such [as] ... polyvinyl chloride plastic." Col 4, lines 13-15. It is further disclosed that this wood/plastic agglomerate may be used in injection molding and extruding processes. Col. 4, lines 26-31.

2. DE2042176 – Extruded Objects and Method of Manufacture (August 25, 1970)

The DE2042176 patent to Showa Marutsutsu Co. ("Showa") discloses combining recycled, waste such as saw dust, with vinyl chloride polymers to form an extrusion mixture. See id. at 5. The saw dust comprises 50-90% by volume of the extrusion mixture, while the vinyl chloride comprises 10-50% by volume. Id. The sawdust is preferably smaller than 4 millimeters (5 mesh) and preferably contains less than 10%

water by weight. See id. at 6. The plastic and sawdust is mixed under heat and extruded into products. Id.

The invention addresses the use of waste material such as wood chips, sawdust, bamboo chips, waste paper, cane trash, crushed grains, husks, coffee grounds, and waste textiles such as asbestos and glass fibers, and waste leather, to make extruded objects for various applications, in the form of, for example, tubes, rods, and tables. The invention also provides a method of manufacture, whereby one or more of the named worthless waste materials is mixed with one or more suitable synthetic resins in an extrusion device, whose cylinder is kept heated, so that the synthetic resin(s) can be molten to the desired dimensions. Synthetic materials can include vinyl chloride resin.

3. Fill Thermoplastics with Wood, MODERN PLASTICS 54 (May 1974)

This article discloses a wood/plastic composite made from 33% wood flour mixed with 67% PVC. See id. at 55. The article describes products made from the composite as having a Young's Modulus (modulus of elasticity) of 850,000 psi and an coefficient of expansion of 1.79×10^{-5} in/in degree F.

The claimed fiber sizes and moisture content would be matters of routine experimentation to one of ordinary skill in the art operating under the parameters disclosed in the article.

4. Maldas & Kokta, Performance of Hybrid Reinforcement in PVC Composites: Part I- Use of Surface-Modified Mica and Wood Pulp as Reinforcements, AMERICAN SOCIETY FOR TESTING AND MATERIALS (1993)

This article discloses mixing up to 35% by weight wood filler with PVC. The wood filler is described as having an aspect ratio of 13.9 (l/d).

This article, although published in 1993, may contain work done in whole or in part before the August 31, 1992 date of filing.

5. Woodhams, Wood Fibers as Reinforcing Fillers for Polyolefins, 24 POLYMER ENGINEERING AND SCIENCE 1166 (1984)

This article discloses a wood/polymer mixture comprising 40-50% by weight wood fibers in high-density polyethylene or polypropylene. See id. at 1167, 1171. The aspect ratio of the wood pulp is described as near 100. See id. at 1166.

While the article experiments with high-density polyethylene and polypropylene, the article also notes that polyvinyl chloride has been utilized in similar experiments where increased strength has been noted. Id. Therefore, one of ordinary skill in the art would have known that PVC could have been interchanged with the polyethylene and polypropylene disclosed in this article.

6. Simpson et al., Composite Materials from Recycled Multi-Layer Polypropylene Bottles and Wood Fibers, page 148-49 (A026989-90)

This article discloses mixing up to 50% by weight wood fibers with polypropylene. See id. at 148. The wood fiber/polypropylene compound was mixed in an extruder and the extruded material was allowed to cool to room temperature. Id. Young's Modulus for the resultant parts was at least 0.4 GPa (58,000 psi).

While the article experiments with polypropylene, one of ordinary skill in the art would know that PVC could be interchanged with the polypropylene disclosed in this article. Further, one of ordinary skill in the art who experiments with PVC within the parameters of the article could obtain a Young's Modulus higher than that disclosed when polypropylene is used.

7. Felix et al., The Nature of Adhesion in Composites of Modified Cellulose Fibers and Polypropylene, 42 JOURNAL OF APPLIED POLYMER SCIENCE 609 (1991)

This article discloses mixing up to 40% by weight wood fibers with polypropylene. See id. at 613. The wood/polypropylene compound is mixed in an extruder. See id. at 611.

While the article disclosed experimentation with polypropylene, one of ordinary skill in the art would know that PVC could be interchanged with the polypropylene disclosed in this article.

8. Yam et al., Composites from Compounding Wood Fibers with Recycled High Density Polyethylene, 30 POLYMER ENGINEERING AND SCIENCE 693 (1990)

This article discloses mixing up to 60% by weight wood fiber with HDPE. See id. at 694. The wood fiber and HDPE is mixed in an extruder and the resultant extrudate was compression molded to make test parts. Id. The moisture content of the wood fiber was "at about 6% by weight." See id. at 693.

While the researchers used HDPE, one of ordinary skill in the art would know that PVC can be interchanged with the HDPE disclosed in this article.

9. Raj et al., Low Temperature Mechanical Properties of Filled High Density Polyethylene, ANTEC '90 1372 (1990) (A027020-22)

This article discloses mixing up to 40% by weight wood fiber with HDPE. See id. at 1373. The wood fiber is described as 60 mesh (0.25mm) in size. Id.

While the researchers used HDPE, one of ordinary skill in the art would know that PVC can be interchanged with the HDPE disclosed in this article.

10. Zusatzstoffe fur Kunststoffe, 28 Plastverarbeiter 199 (1977) (A036388-390)

This article discloses 33% wood flour and 67% PVC. Binding material with 30% to 40% wood flour and polymethylmethacrylate was manufactured in Japan through radiation of a mixture of sawdust and monomeric MMA.

11. Myers et al., Effects of Composition and Polypropylene Melt Flow on Polypropylene – Waste Newspaper Composites, ANTEC '92 602 (1992) (A027081-82)

This article discloses 42% wood flour mixed with polypropylene. See id. at 602. The tensile modulus is disclosed as over 4.2 GPa (over 600,000 psi).

While the researchers used polypropylene, one of ordinary skill in the art would know that PVC can be interchanged with the polypropylene disclosed in this article.

This article, published the same year as the date of filing, is presumptively prior art. Additionally, absent any evidence to the contrary of an earlier date of invention, Fiber Composites reasonably relies on the filing date as the date of invention.

Furthermore, this article may evidence knowledge that existed prior to the date of the invention.

12. US Patent No. 5,008,310 – Polymer Composites Based Cellulose-V (April 16, 1991)

US Patent No. 5,008,310 ("the '310 patent) to Beshay discloses a wood fiber composite grafted with an isocyanate bonding agent. The specific example discloses 10-40% by weight fillers mixed with 60-90% by weight of PVC. Col. 6, lines 14-19. The filler is described as "wood pulp… derived from aspen and ground to mesh size 60." Col. 6, lines 7-9.

13. US Patent No. 4,228,116 – Process for Producing Remoldable Panels (October 1980)

US Patent No. 4,228,116 ("the '116 patent") to Colombo discloses using a mixture comprising about 40-60% by weight thermoplastic resin and about 40-60% by weight wood particles. See, e.g., Abstract. The preferred thermoplastic resin is polypropylene, but it is noted that "other…thermoplastic polymers...can be used to prepare the mixture." Col. 7, lines 30-33. Claim 1 claims only thermoplastics, including PVC. Claim 2 claims only polypropylene.

14. US Patent No. 4,687,793 – Thermoplastic Resins Containing Gloxal Heat Treated Cellulosic Fillers (August 18, 1987)

US Patent No. 4,687,793 ("the '793 patent") to Motegi discloses a wood/plastic mixture comprising 10-65% by weight cellulosic filler. Col. 2, lines 5-10. The preferred filler quantity is 30-50% by weight. Col. 3, lines 40-41. The cellulosic filler is described as including wood flour and wood chips. Col. 1, lines 64-66. The cellulosic filler has a preferred mesh size of 10 (2mm), but has no particular limitations. Col. 2, lines 45-47. The plastic can be PVC. Col. 2, lines 16-22. The mixture can be pellitized for use in extruders or injection molders. Col. 4, lines 24-28. See also claims 3 and 4.

15. US Patent No. 3,878,143 – Method of Preventing Corrosion in Connection with Extrusion of Mixtures Containing Polyvinyl Chloride and Wood Flour or Similar Cellulosic Material, and Analogous Mixtures Containing Polystyrene or Acrylonitrile-Butadiene-Styrene resin, Respectively (April 15, 1975)

US Patent No. 3,878,143 ("the '143 patent") to Baumann discloses extruding a mixture of PVC and wood flour. The specific example given describes a mixture containing 100 parts by weight PVC and 50 parts by weight wood flour. Col. 2, lines 29-51.

16. US Patent No. 4,594,372 – Polyvinyl Chloride Composition (June 10, 1986)

US Patent No. 4,594,372 ("the '372 patent") to Natov discloses a mixture of PVC and wood meal. Specifically, the '372 patent discloses a mixture of 100 parts by weight PVC and 5-95 parts by weight wood meal. Col. 2, lines 3-8. The 5-95 parts by weight correspond to 5-49% by weight wood meal. This is based on a mix consisting of only wood meal and PVC. The wood meal is described as having a particle size of 100-500 microns (0.1-0.5 mm). Col. 2, lines 7-8. The composition is mixed then extruded. Col. 2, lines 23-26.

17. US Patent No. 4,851,458 – Use of Cellulose Fibers for Structurally Modifying Polyvinyl Chloride Articles (July 1989)

US Patent No. 4,851,458 ("the '458 patent") to Hopperdietzel discloses a wood/PVC mixture with 40% by weight wood fibers. Col. 2, lines 21-25. The wood fibers have an aspect ratio of at least 2. Col. 2, lines 26-30. The examples use a PVC-homopolymeric resin. Col. 5, lines 21-30. Example 5 of the '458 patent discloses an extruded profile with shrinkage of 0.4 percent (1.74×10^{-5} °F).

18. US Patent No. 5,082,605 – Method for Making Composite Material (Jan. 1992)

US Patent No. 5,082,605 ("the 605 patent") to Brooks discloses a wood/polymer mixture comprising 40-60% by weight filler and 40-60% by weight polymer. Col. 2,

lines 28-33. The mixture is useful in making extrusions of window sills and sashes, as well as other building materials. Col. 2, lines 20-25. The polymer is preferably polyethylene, but other plastics can be used. Col. 4, 10-15. The wood fiber is described as waste wood having a width or diameter less than 0.125 inches (3.2 mm) with an aspect ratio from 2 to 12. Col. 3, 27-35. The resultant mixture is wood fibers dispersed in a continuous phase polymeric material. Col. 5, lines 55-59. The material is reduced to particles (pellets) having a maximum dimension of about 1.5 inches or less, so they can be fed into an extruder at a later time. Col. 6, lines 1-8.

This patent, published more than six months before the August 31, 1992 date of filing, is presumptively prior art. Additionally, absent any evidence to the contrary of an earlier date of invention, Fiber Composites reasonably relies on the filing date as the date of invention. Furthermore, this article may evidence knowledge that existed prior to the date of the invention.

19. US Patent No. 5,088,910 – System for Making Synthetic Wood Products from Recycled Material (February 1992)

US Patent No. 5,088,910 ("the '910 patent") to Goforth relates to US Patent No. 5,082,605, described above. The '910 patent describes a device and system for making the wood/polymer mixture described above.

This patent, published more than six months before the August 31, 1992 date of filing, is presumptively prior art. Additionally, absent any evidence to the contrary of an earlier date of invention, Fiber Composites reasonably relies on the filing date as the date of invention. Furthermore, this article may evidence knowledge that existed prior to the date of the invention.

20. US Patent No. 4,610,900 – Wood-Like Molded Product of Synthetic Resin (September 9, 1986)

US Patent No. 4,610,900 ("the '900 patent") to Nishibori discloses an extruded or molded part made from a wood/polymer mixture. Abstract. For extrusion products, the mixture will contain 15-80% by weight of wood fiber. Col. 2, lines 39-45. The polymer can be a vinyl chloride polymer. Col. 2, lines 34-38. The wood fibers are described as

particles of 80-200 mesh (0.177-0.074 mm), which are more particularly 150 mesh or finer. Col. 2, lines 26-30. The water content of the wood fiber is less than 5% by weight. Col. 2, lines 29-32.

21. US Patent No. 4,203,876 – Moldable compositions Based on thermoplastic Polymers, Synthetic Elastomers and Vegetable Fibrous Materials, and Use of These Compositions for Calendering and Thermoforming (May 20, 1980)

US Patent No. 4,203,876 ("the 876 patent") to Dereppe discloses wood fibers/polymer mixtures. For example, the '876 patent describes a mixture containing 55% pine sawdust mixed with 38% propylene homopolymer, and a mixture containing 55% pine sawdust and 45% propylene homopolymer. Cols. 5-6. While propylene is described in the examples, the patent discloses that vinyl chloride resins, particularly those made by homopolymerization, are preferred. Col. 2, lines 30-34. The wood fibers are described as between 0.05 and 1.0 mm, and more particularly 0.2 mm. Col. 3, lines 28-31.

22. US Patent No. 4,505,869 – Method for Manufacturing Wood-Like Molded Product (March 19, 1985)

US Patent No. 4,505,869 ("the '869 patent") to Nishibori discloses a wood/plastic mixture comprising 20-50% by weight wood fibers, Col. 4, lines 16-19, which can be used to form window frames, sills, and other building materials, Col. 5, lines 1-10. The polymer can be a polyvinyl chloride. Col. 1, line 68; see also Claim 7. The wood fiber is described as wood chips of 100 mesh (0.149 mm). Col. 2, lines 3-5. The water content of the aggregate is less than 13% by weight, but preferably between 3 and 5%. Col. 2, lines 38-42.

23. X. Xanthos, *Processing Conditions and Coupling Agent Effects in Polypropylene/Wood Flour Composites*, PLASTICS AND RUBBER PROCESSING AND APPLICATIONS (1983)

This article discloses polypropylene composites containing 30 and 40 weight percent wood flour.

It would be obvious to one of ordinary skill in the art to exchange the polypropylene used here with PVC, in light of other references.

24. C. Klason, J. Kubat and H.E. Stromvall, The Efficiency of Cellulosic Fillers in Common Thermoplastics. Part 1. Filling without Processing Aids or Coupling Agents, INTERNATIONAL JOURNAL POLYMERIC MATER (1984)

This article discloses high density polyethylene (HDPE) with wood-based fillers having modulus values in the range of 25-40 GPa.

It would be obvious to one of ordinary skill in the art to exchange the HDPE used here with PVC, in light of other references.

25. R.G. Raj, B.V. Kokta, C. Daneault, A Comparative Study on the Effect of Aging on Mechanical Properties of LLDPE-Glass Fiber, Mica, and Wood Fiber Composites, JOURNAL OF APPLIED POLYMER SCIENCE (1990)

This article discloses that a linear low density polyethylene (LLDPE) reinforced with 0-40 weight percent wood fiber had better results than LLDPE filled with mica with regard to tensile strength, elongation, and fracture energy.

26. R.G. Raj, B.V. Kokta, D. Maldas and C. Daneault, Use of Wood Fibers in Thermoplastics VII The Effect of Coupling Agents in Polyethylene- Wood Fiber Composites, JOURNAL OF APPLIED POLYMER SCIENCE (1989)

This article discloses that linear low density polyethylene (LLDPE) filled with pretreated wood fibers mixed at 0-40 weight percent produced a significant improvement in tensile strength and modulus.

It would be obvious to one of ordinary skill in the art to exchange the LLDPE used here with PVC, in light of other references.

27. R.G. Raj, B.V. Kokta and C. Daneault, Polypropylene-Wood Fiber Composites: Effect of Fiber Treatment on Mechanical Properties, INTERN. J. POLYMERIC MATER. (1989)

This article discloses that linear polypropylene (PP) reinforced with wood fibers at 0-40 weight percent improved tensile properties where the fibers were shorter and pre-treated before being incorporated in the polymer.

28. Raj et al., Use of Wood Fiber as a Filler in Polyethylene: Studies on Mechanical Properties, PLASTICS AND RUBBER PROCESSING AND APPLICATIONS (1989)

This article discloses that linear polypropylene (PP) reinforced with wood fibers at 0-40 weight percent improved tensile properties where the fibers were shorter and pre-treated before being incorporated in the polymer.

29. Mitsuno et al., US Patent No. 5,008,310, Polymer Composites Based Cellulose-V (April 16, 1991)

This patent discloses a filler-containing polypropylene resin composition comprising from 30-90 weight percent polypropylene resin, from 5-50 weight percent filler, and from 2.5-38 weight percent ethylene copolymer exhibiting high impact strength and high heat resistance.

30. Excerpt from Book by David B. Todd [To Be Provided]

This book discloses that producing a compounded product in pelletized form offers the advantages of: simpler feeding systems, less variability in product with the homogeneous feed, greater extrusion capacity and lower shipping costs due to higher bulk density. See id. at 259.

31. Excerpt from Book by Paul G. Andersen [To Be Provided]

"Werner & Pfleiderer has made both water ring (WRG) and underwater (UG) pelletizers for almost 30 years. The WRG is used on high-temperature engineering resins or materials where the fast quench of the UG makes the product too brittle to cut. It ranges from the WRG-80, which handles 100 kg/h, to the WRG-400 at 12,000kg/h." Id. at 99.

32. Kokta et al., Composites of Poly(Vinyl Chloride) and Wood Fibers. Part II. Effects of Chemical Treatment, 11 POLYMER COMPOSITES 84 (1990)

This article discloses mixing up to 30% wood filler, both pulp and saw dust, with PVC. The wood filler is disclosed as having an average fiber length of 0.75mm.

33. Kokta et al., Composites of Polyvinyl Chloride-Wood Fibers. I. Effects of Isocyanate As A Bonding Agent, 11 POLYMER COMPOSITES 87 (1990)

This article discloses mixing up to 30% wood filler, both pulp and saw dust, with PVC. The wood filler is disclosed as having an average fiber length of 0.75mm.

34. Kokta et al., Composites of Polyvinyl Chloride-Wood Fibers. III: Effect of Silane as Coupling Agent, 12 Journal of Vinyl Tech. 146 (1990)

This article discloses mixing up to 30% wood filler, both pulp and saw dust, with PVC. The wood filler is disclosed as having an average fiber length of 0.75mm.

35. Kokta et al., Composites of Polyvinyl Chloride-Wood Fibers. IV: Effect of the Nature of Fibers, 11 Journal of Vinyl Tech. 90 (1989)

This article discloses mixing up to 30% wood filler, both pulp and saw dust, with PVC. The wood filler is disclosed as having an average size of mesh 40 (0.42mm) and 60 (0.25mm). The mixture of wood and polymer was first mixed mechanically and second by the extruder. The extruded samples were then ground to mesh size 20 (0.84mm).

36. Beshay, Reinforcement of Polyvinyl Chloride (PVC) and Polystyrene (PS) with Cellulosic Fibers Treated with Silane, 3 Journal of Thermoplastic Composite Materials 264 (1990)

This article discloses mixing up to 30% by weight wood pulp into PVC. The wood pulp is described as ground to 60 mesh (0.25mm).

37. Kokta et al., Composites of Polyvinyl Chloride-Wood Fibers. I. Effects of Isocyanate As A Bonding Agent, 29 Polym.-Plast. Tech. Eng. 87 (1990)

This article discloses mixing up to 30% wood filler, both pulp and saw dust, and PVC. The wood filler is disclosed as having an average fiber length of 0.75mm.

38. Balatinecz, John J. & Woodhams, Raymond T., *The Manufacture of Plastic Lumber from Industrial and Consumer Waste* (1991)

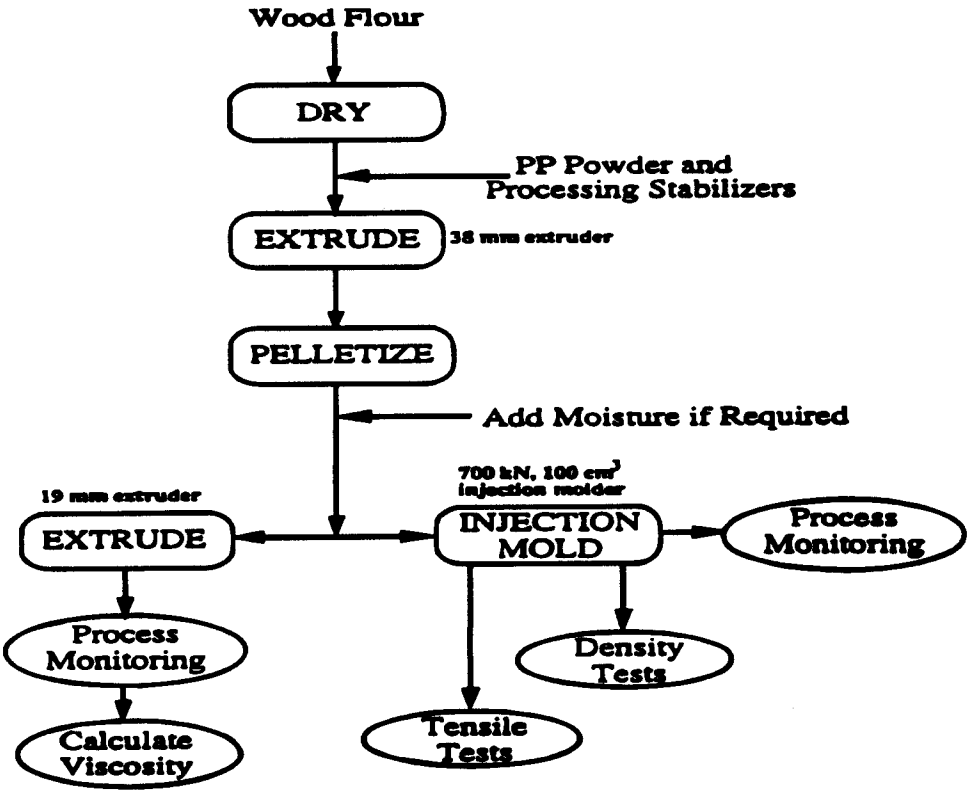
This article discloses a method of concerting waste paper and commingled plastics into useful building materials. The plastics waste disclosed includes polyethylenes, polypropylenes, vinyls, and styrenics. The wood fiber content is disclosed as varying from 5 to 95 percent. Id. at 2.

39. Wolcott, Michael P., Wood Fiber-Polymer Composites: Fundamental Concepts, Processes, and Material Options, Copyright 1993 by the Forest Products Society

This publication is a collection of selected papers presented at the 1st Wood Fiber-Plastic Composite Conference in Madison, Wisconsin in April 1991 and at a technical forum session at the 45th annual meeting of the Forest Products Research Society in New Orleans, Louisiana in June 1991. As such, this publication, although published in 1993, reflects written work produced more than one year prior to the filing of the patents in suit. This publication, therefore, invalidates the patents in suit, and Fiber Composites relies on it as a whole. The properties disclosed by the patents in suit are inherent in processes that are described in this publication. What follows are specific examples of portions of this work that evidence the invalidity of the patents in suit. Further evidence of the invalidity of the patents in suit can be demonstrated through analyses and testing of the properties cited in this publication.

The work of Reitveld et al., The Influence of Absorbed Moisture on the Processability and Properties of a Wood Flour-Filled Poly Propylene, 39-48, discloses composites with 45 and 55 weight percent wood pelletized on a single screw extruder. At page 40, the processes disclosed include drying wood flour overnight at 110 degrees Celsius and then dry-blending it with polypropylene powder plus several processing stabilizers. Then, two batches of wood flour - polypropylene composite, one at 45 weight percent wood flour and the other at 55 weight percent wood flour, were separately

compounded on a 38-mm extruder. The air-cooled extruded strands were then pelletized and subsequently stored in airtight cans. The moisture content of the pelletized feed-stock was adjusted to either 2.5 or 5.0 weight percent based on the mass of dried wood



flour present in the wood flour filled polypropylene. See the figure on the following page for a schematic of the experimental procedure.

The works of Myers et al., Wood Flour and Polypropylene or High-Density Polyethylene Composites: Influence of Maleated Polypropylene Concentration and Extrusion Temperature on Properties, Myers, Gonzalex, and Coberly, C.A., 49-56, and Maldas & Kokta, Role of Coupling Agents and Treatments on the Performance of Wood-Fiber-Thermoplastic Composites, 112-120, disclose the benefits of compatibilizing agents to increasing the compatibility and bonding of wood and thermoplastics. Maldas & Kokta expressly point to developing a hydrophobic coating of a compatible polymer on the surface of the filler before mixing with the polymer matrix.

The work of Mohanakrishnan et al., Reactive Extrusion Processing of Polypropylene-Lignocellulosic Blend Materials, 57-62, discloses a reactive extrusion

processing to fabricate blends of 20 and 30 weight percent low density hardwood pulp with polypropylene in a twin screw extruder. The article further discloses the result that a blend matrix of modified polymer (MAPP) with a lignocellulosic material exhibited improved tensile properties over virgin polymer and maleated polymer, unlike a blend matrix of polypropylene-ethylene copolymer with a lignocellulosic material.

40. Rowell, Roger M., Opportunities for Value-Added Bio-Based Composites, Pacific Rim Bio-Based Composites Symposium, November 9-13, 1992, Rotorua, New Zealand

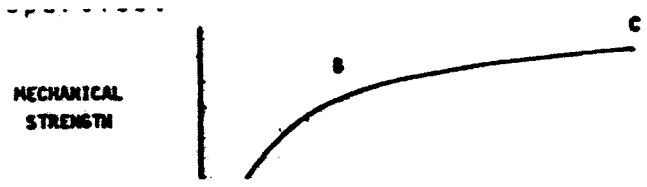
This article clearly and concisely describes ways in which the strength properties of a lignocellulosic composite can be polymerized. It further references observations made more than a year prior to the filing of the patents in suit, including the notion that usually the polymer enters the cell lumen and does not enter the cell wall.

The combination of lignocellulosics with thermoplastics was being performed in an effort to decrease prices for plastics. One of ordinary skill in the art at the time of the invention claimed by the patents in suit was motivated to add lignocellulosic powder or fiber to plastics to provide a cost reduction to the plastic industry and an increased value for the biobased component in the lignocellulosic industry.

41. Karaim, B.W. & Szabo, T., Canada Alberta Forest Resource Development Agreement, April 1, 1984- March 31, 1989

This publication is a collection of papers. The properties disclosed by the patents in suit are inherent in processes that are described in this publication. What follows are specific examples of portions of this work that evidence the invalidity of the patents in suit. Further evidence of the invalidity of the patents in suit can be demonstrated through analyses and testing of the properties cited in this publication.

The work of Tingley et al., Opportunities of Treating Alberta Wood Products with Vinyl Monomers, 7-33, describes the history of polymerization and the advantages to using vinyl-type monomers to treat wood. The graph below of the mechanical strength versus degree of polymerization depicts the additive effect of intermolecular interactions



between the repeating units along the polymer chain. It demonstrates that polymers with low degrees of polymerization are not useful structural materials (at A), that mid-range polymers have sufficient strength to be useful (at B), and that the polymer has practical application at higher ranges (B to C).

42. Balatinecz et al., Properties and Possible Applications of Wood Fiber-Polypropylene Composites, WOOD ADHESIVES (1990)

This article discloses wood at 0-50 weight percent with polypropylene.

43. Poster Abstracts, Woodfiber-Plastic Composites Conference, The University-Industry Research Program (May 2-4 1993)

The abstracts gathered in this compilation reflect work done in whole or in part before the filing of the patents in suit that renders them obvious. For example, Snider's Use of a Unique Twin-Screw mixer to Recycle Cellulosic Materials, #42, discloses use of a twin screw to mix without breaking fibers.

44. Caulfield, F. Daniel, Rowell, Roger M. & Sanadi, Anand R., Reinforcing Polypropylene With Natural Fibers, J. Reinf. Plastic Composites, 1994, J. Wood Chem. And Tech. 1986

This publication is supported by a grant application submitted February 7, 1992 for research beginning June 1, 1992. It discloses methods of characterizing the interface in reinforced composites and compares different surface treatments via control of tests using force versus embedded length data. See id. at 7.

45. Coran et al., U.S. 4,323,625, Composites of Grafted Olefin Polymers and Cellulose Fibers (filed Apr. 6, 1982).

This patent discloses methods of reducing fiber-to-fiber interaction so as to facilitate mixing into composites. Furthermore, it discloses composites consisting of from 2 to 55 weight percent of discontinuous cellulose fibers, the remaining 98 to 45 weight percent being a matrix comprising from 2 to 99.9 parts by weight of a polymer. It also discloses that the average aspect ratio of the cellulose fibers strongly affects the

modulus obtainable in the composites of the invention. It points to preferred fibers as having average aspect ratios from 20 to 200.

B

U.S. Patent 5, 486,553

1. A polymer wood thermoplastic composite structural member, suitable for use as a replacement for a wood structural member,

Ref. 1., p. 5, lines 3-6 – can be used for window frames
Ref. 3, -- profile extrusions, such as door thresholds

which thermoplastic composite structural member comprises a composite member with a Young's modulus of greater than 500,000,

Ref. 3 – Young's Modulus of 850,000

and a coefficient of thermal expansion less than 3 x 10^{-5} in/in-.degree F

Ref. 3 – coefficient of thermal expansion of 3.2 x 10^{-5} cm/cm degree C = 1.79 x 10^{-5} in/in-degree F

and which composite member comprises a continuous organic phase comprising about 35 to 65 wt-% of a polymer comprising vinyl chloride and, dispersed in the continuous phase, about 35 to 55 wt-% of wood fiber having an aspect ratio of at least about 2.

Ref. 1, p. 4, lines 14-15 (PVC)
p. 4, lines 17-20 (5-90% plastic and 95-10% wood, prefer 40-60 wt% plastic and 60-40 wt% wood)
p. 4, lines 5-9 (sawdust and wood flour)
Ref. 3 – 33 % wood flour, 67 wt% PVC

Ref. 14, col. 3, lines 39-42 (10-65%, 20-55 wt% and preferably 30-50wt% wood flour),
Col. 3, line 30 (PVC)

2. The composite structural member of claim 1 wherein the coefficient of thermal expansion is about 1.5 to 2.5 x 10^{-5} in/in-degree F.

Ref. 3 – 1.79 x 10^{-5} in/in-degree F

3. The composite structural member of claim 1 having a rectangular cross-section with a width greater than about 1 cm and a depth greater than about 1 cm.

Ref. 3 – 0.1 to 0.4 in (0.254 cm – 1.106 cm) profiles
2.5 mm to 10 mm profiles

4. The composite member of claim 2 having a square cross-section with a width greater than about 1 cm.

Ref. 3 – 0.4 in (1.016 cm) profile

5. The composite member of claim 1 having a length greater than about 30 cm.

Ref. 3 – extrusions generally can be continuous, i.e. very long.

6. The composite member of claim 1 having a shaped member cross-section.

Ref. 3 – see picture showing shaped profiles.

22. A polymer wood composite rail, suitable for use as a replacement for a wood rail,

Ref. 1, p. 5, lines 3-6 (suitable for window frames)

which composite rail comprises an elongated thermoplastic extrudate having a Young's modulus of greater than 7.5×10^{-5} and a coefficient of thermal expansion between 1.5 and 3.0×10^{-5} in/in-degree F

Ref 3 – Young's Modulus (E) of 850,000
Coefficient of thermal expansion = 1.79×10^{-5}

and which composite member comprises a continuous organic phase comprising about 35 to 65 wt-% of a polymer comprising vinyl chloride and, dispersed in the continuous phase, about 35 to 55 wt-% of wood fiber having an aspect ratio of at least about 2.

Ref. 1, p. 3, lines 14-15 (PVC)
p. 4, lines 17-20 (5-90% plastic and 95-10% wood, prefer 40-60 wt% plastic and 60-40 wt% wood)
p. 4, lines5-9 (sawdust and wood flour)
Ref. 3 – 33 % wood flour, 67 wt% PVC

Ref. 14, col. 3, lines 39-42 (10-65%, 20-55 wt% and preferably 30-50wt% (wood flour), col. 3, line 30 (PVC)

U.S. Patent No. 5,539,027

1. A wood-thermoplastic polymer composite structural member, suitable for use as a replacement for a wood structural member,

Ref. 1, p. 4, lines 26-29 (can be used to extrude products such as molding in the furniture and woodworking industry)
p. 5, lines 3-5 (window frames)

which thermoplastic composite structural member comprises an extrudate having a Young' modulus of greater than 500,000, and a coefficient of thermal expansion less than 3 $x10^{-5}$ in/in-degree

Ref. 3 – Young's Modulus = 850,000
Coefficient of thermal expansion – 1.79 x 10^{-5} in/in degree F

and which composite member comprises a continuous organic phase comprising polyvinyl chloride and, dispersed in the continuous phase, 30-50 wt-% of a wood fiber having an aspect ratio of at least about 2 to provide structural properties to the composite.

Ref. 1, p. 4, lines 14-15 (PVC)
p. 4, lines 17-20 (5-90% plastic and 95-10% wood, prefer 40-60 wt% plastic and 60-40 wt% wood)
p. 4, lines 5-9 (sawdust and wood flour)
Ref. 3 – 33 wt% wood flour, 67 wt% PVC

Ref. 14, col. 3, lines 39-42 (10-65%, 20-55 wt% and preferably 30-50wt% (wood flour), col. 3, line 30 (PVC)

2. The composite structural member of claim 1 wherein the polymer is a homopolymer and the composite has a coefficient of thermal expansion is about 1.5 x 10^{-5} in/in-degree F to 2.5 x 10^{-5} in/in-degree F.

Ref. 3 – Coefficient of thermal expansion – 1.79 x 10^{-5} in/in degree F

3. The composite structural member of claim 1 having a rectangular cross-section with a width greater than about 1 cm and a depth greater than about 1 cm.

Ref. 3 – See picture showing profiles of 2.5 to 10 mm

4. The composite member of claim 1 having a square cross-section with a width greater than about 1 cm.

Ref. 3 – See picture showing profiles of 2.5 to 10 mm

5. The composite member of claim 1 having a length greater than about 30 cm.

Ref. 3 – the extrusion may be continuous

6. The composite member of claim 1 having a shaped member cross-section.

Ref. 3 – See picture showing profiles of 2.5 to 10 mm

9. The composite member of claim 6 which comprises a rail.

Ref. 1 , p. 5, lines 3-6 (window frame)

21. A composite composition, capable of extrusion into a dimensionally stable structural member, which composition comprises a thermoplastic material consisting essentially of:

Ref. 1, p.4, lines 26-29
p. 5, lines 3-6
Ref. 3 -- shows profiles made from PVC

(a) about 40 to 70 wt-% of a polymer comprising vinyl chloride;

Ref. 1, p.4, lines 14-15
p. 4, lines 17-20
Ref. 3 – 67 wt % PVC

(b) about 30 to 50 wt-% of wood fiber having a minimum width of about 0.3 mm and a minimum length of about 0.54 mm and an aspect ration of greater than about 1.8;

Ref. 1, p. 4, lines 17-20
p. 4, lines 5-9

Ref. 3 – 33 wt% wood flour

Ref. 14, col. 3, lines 39-42

(c) about 0.1 to 25 wt-% of an intentionally recycled impurity comprising thermoplastic polymer, an adhesive, a paint, a thermoplastic resin or mixtures thereof; and

Ref. 1, p. 4, lines 21-23 (the plastic may consist of waste raw material of mixed quality and varying purity)
p. 4, lines 8-9 (sawdust waste from sawmill or other wood-working industry)

(d) less than about 10 wt-% water; wherein the polymer and wood fiber are mixed at an elevated temperature and pressure such that an intimate admixture is formed in which the wood fiber is dispersed throughout a continuous polymer phase and wherein the composite has a Young's modulus greater than 600,000 psi.

Ref. 1, p. 3, lines 15-16 ("the waste is dried")
p. 4, lines 10-12 ("the wood has moisture content of 5-45% by wt, suitably 10-40%)

Ref. 3 – shows extruded profiles; extrusion inherently occurs at elevated temperature and pressure; Young's Modulus = 850,000

Ref. 14, col. 1, lines 17-20 (10% of moisture weight, dried 4-7% by weight, any higher can cause bubbles/blisters)

22. The composition of claim 21 wherein the polymer comprises a polyvinyl chloride homopolymer.

Ref. 17, col. 5, lines 21-20 (Examples Uses PVC homopolymeric resin)

28. The composition of claim 21 wherein the wood fiber has a fiber width of about 0.3 to 1.5 mm and an aspect ratio of about 2 to 7.

Ref. 1, p. 5, lines 5-9

29. The composition of claim 21 wherein the wood concentration of water comprises about 0.01 to 3.5 wt-% of the composition.

Ref. 14, col. 1, lines 17-20 (10% moisture, dried 4-7%, can cause bubbles)

U.S. Patent No. 5,932,334

19. A thermoplastic composite composition, capable of extrusion into a dimensionally stable structural member, which consists essentially of a thermoplastic composition which comprises:

Ref. 1, p. 4, lines 26-29
p. 5, lines 3-6
Ref. 3 – woodflour/PVC shapes

(a) a continuous phase comprising a polyvinyl chloride homopolymer;

Ref. 17, col. 5, lines 21-30

(b) an effective amount of wood fiber having a minimum width of 0.1 mm and an aspect ratio of greater than about 1.8 to provide structural properties to the composite;

Ref. 1, p. 4, lines 5-9

(c) about 0.01 to 25 wt % of an intentionally recycled impurity comprising thermoplastic polymer, an adhesive, a paint, a thermoplastic resin or mixtures thereof; and

Ref. 1, p. 4, lines 8-9, 21-23

(d) less than about 10 wt % water; wherein the polyvinyl chloride homopolymer and wood fiber are mixed at elevated temperature and pressure such that an intimate admixture is formed and the wood fiber is dispersed throughout the continuous thermoplastic polyvinyl chloride homopolymer phase and the composite has a Young's modulus of at least about 600,000 psi.

Ref. 1, p. 3, lines 15-16
p. 4, lines 10-12

Ref. 3 – refers to extruded materials, which are inherently processed at elevated temperature and pressures, Young's Modulus = 850,000

20. The composition of claim 19 wherein the polymer comprises a polyvinyl chloride homopolymer.

Ref. 17, col. 5, lines 21-30

24. The composition of claim 20 wherein the polymer has a molecular weight of about 95,000.+-.50,000.

26. The composition of claim 19 wherein the wood fiber has a fiber width of about 0.3 to 1.5 mm, a fiber length of about 1 to 10 mm and a aspect ratio of about 2 to 7.

Ref. 1, p. 4, lines 5-9

27. The composition of claim 19 wherein water comprises about 0.01 to 3.5 wt % of the composition.

Ref. 1, p. 3, lines 15-16
p. 4, lines 10-12

Ref. 14, col. 1, lines 17-20

U.S. Patent No. 6,015,611

41. A composite composition, capable of extrusion into a dimensionally stable structural member, which composition comprises:

Ref. 1, p. 4, lines 26-29
p. 5, lines 3-6
Ref. 3, extruded shapes

(a) about 40 to 70 wt-% of a polymer comprising vinyl chloride;

Ref. 1, p. 4, lines 14-15
p. 4, lines 17-20
Ref. 3 – 67 wt% PVC

(b) about 30 to 50 wt-% of wood fiber having a minimum width of 0.3 mm and a minimum length of 1 mm and an aspect ratio of greater than about 1.8;

Ref. 1, p. 4, lines 5-9, 17-20
Ref. 3 – 33 wt% wood flour

(c) about 0.01 to 25 wt-% of an intentionally recycled impurity comprising thermoplastic polymer, an adhesive, a paint, a thermoplastic resin or mixtures thereof; and

Ref. 1, p. 4, lines 8-9, 21-23

(d) less than about 10 wt-% water; wherein the wood fiber is dispersed throughout a continuous polymer phase.

Ref. 1, p. 3, lines 15-16
p. 4, lines 10-12

42. The composition of claim 41 wherein the polymer comprises a polyvinyl chloride homopolymer.

Ref. 17, col. 5, lines 21-30

43. The composition of claim 42 wherein the polymer has a molecular weight of about 95,000.+-.50,000.

48. The composition of claim 41 wherein the wood fiber has a fiber width of about 0.3 to 1.5 mm, a fiber length of about 1 to 10 mm and a aspect ratio of about 2 to 7.

Ref. 1, p. 4, lines 5-9

49. The composition of claim 41 wherein the concentration of water comprises about 0.01 to 3.5 wt-% of the composition.

Ref. 1, p. 3, lines 15-16
p. 4, lines 10-12
Ref. 14, col. 1, lines 17-20

United States Patent No. 6,015,612

1. A thermoplastic polymer composite composition capable of formation into a structural profile or member, the thermoplastic composite composition comprising:

Ref. 1, p. 1, lines 15-18
p. 5, lines 3-6

Ref. 3 –extruded shapes

(a) an effective amount, sufficient to form a continuous phase in the composite, of a thermoplastic polymer composition comprising vinyl chloride; and

Ref. 1, p. 4, lines 14-15
Ref. 3 – PVC extrusion w/ 67 wt% PVC

(b) an effective amount of wood fiber having a minimum aspect ratio of about 2 to provide structural properties to the composite;

Ref. 1, p. 4, lines 5-9
Ref. 3 – 33 wt % wood flour

wherein the polymer and wood fiber are mixed at elevated temperature and pressure such that the composition comprises less than about 8 wt-% water, the composition comprises an intimate admixture of wood fiber dispersed throughout the continuous thermoplastic polymer phase such that the polymer wets and penetrates into the interior volume of wood fiber cells,

Ref. 1, p. 3, lines 15-16
p. 4, lines 10-12

Ref. 3 – "extrusion" inherently at elevated temperature and pressures

Ref. 14, col. 1, lines 17-20

the composition is a recyclable thermoplastic and the composite has a Young's modulus of at least about 500,000 psi.

Ref. 3 – Young's Modulus of 850,000

9. The composition of claim 1 wherein the polymer comprises a polyvinyl chloride homopolymer.

Ref. 17, col. 5, lines 21-30

14. The composition of claim 1 wherein the polymer has a molecular weight (M.sub.w) of about 95,000.+-.50,000.

16. The composition of claim 1 wherein the wood fiber has a fiber width of up to about 1.5 mm, a fiber length of up to about 10 mm and a aspect ratio of about 2 to 7.

Ref. 1, p. 4, lines 5-9

17. The composition of claim 1 wherein the water comprises about 0.1 to 5 wt-% of the composition.

Ref. 1, lines p. 3, lines 15-16
p. 4, lines 10-12

Ref. 14, col. 1, lines 17-20